WHAT IS CLAIMED IS:

1. A method of manufacturing a semiconductor device comprising:

forming a diffusion region by introducing an arsenic impurity into an element region of a silicon substrate, which is isolated by an element isolating insulation film, to a concentration of 1×10^{20} cm^{-3} or more with a gate electrode formed over a gate insulating film being employed as a mask;

depositing nickel metal over the entire top surface of the silicon substrate;

heat-treating said silicon substrate having said nickel metal deposited thereon at a first temperature of less than 400℃ while leaving said nickel metal on the surface of said element isolating insulation film, thereby forming a nickel silicide film containing di-nickel silicide (Ni_2Si) on a surface of said the diffusion region;

removing an unreacted portion of said nickel metal deposited on said element isolating insulation film;

heat-treating said silicon substrate having said unreacted nickel metal removed therefrom at a second temperature of 450℃ or more, thereby forming a nickel monosilicide (NiSi) film having an arsenic compound layer on a surface thereof;

etching away said arsenic compound layer by using an alkaline liquid;

depositing an interlayer insulating film over the entire top surface of said silicon substrate; and

forming a wiring layer piercing through said interlayer insulating film.

2. The method of manufacturing a semiconductor device according to claim 1, wherein said alkaline liquid comprises a mixed solution containing aqueous ammonia and aqueous hydrogen peroxide.

3. The method of manufacturing a semiconductor device according to claim 1, wherein said alkaline liquid is a mixed solution containing choline and aqueous hydrogen peroxide.

4. The method of manufacturing a semiconductor device according to claim 1, wherein said first temperature is 250℃ or more.

5. The method of manufacturing a semiconductor device according to claim 1, wherein said second temperature is 550℃ or less.

6. The method of manufacturing a semiconductor device according to claim 1, wherein heat-treating at said first temperature is performed for a period of less than five minutes.

7. The method of manufacturing a semiconductor device according to claim 1, wherein heat-treating at said second temperature is performed for a period of less than five minutes.

8. The method of manufacturing a semiconductor

device according to claim 1, wherein depositing said interlayer insulating film and forming said wiring layer are performed at a temperature lower than said second temperature.

9. The method of manufacturing a semiconductor device according to claim 1, wherein depositing said interlayer insulating film and forming said wiring layer are performed at a temperature of 500℃ or less.

10. A method of manufacturing a semiconductor device comprising:

forming a diffusion region by introducing arsenic impurity into an element region of a silicon substrate, which is isolated by an element isolating insulation film, to a concentration of 1×10^{20} cm^{-3} or more with a gate electrode formed over a gate insulating film being employed as a mask;

depositing a metal film over the entire top surface of said silicon substrate;

heat-treating said silicon substrate having said metal film deposited thereon at a first temperature of less than 400℃ while leaving said metal film on the surface of said element isolating insulation film, thereby forming a first metal silicide film on a surface of said diffusion region;

removing an unreacted portion of said metal film deposited on said element isolating insulation film;

heat-treating said silicon substrate having said

unreacted metal film removed therefrom at a second temperature of 450℃ or more, thereby forming a second metal silicide film having a arsenic compound layer on a surface thereof;

etching away said arsenic compound layer by using an alkaline liquid;

depositing an interlayer insulating film over the entire top surface of said silicon substrate; and

forming a wiring layer piercing through said interlayer insulating film.

11. The method of manufacturing a semiconductor device according to claim 10, wherein said metal film is a nickel film, said first metal silicide is di-nickel silicide (Ni_2Si), and said second metal silicide is nickel monosilicide (NiSi).

12. The method of manufacturing a semiconductor device according to claim 10, wherein said alkaline liquid comprises a mixed solution containing aqueous ammonia and aqueous hydrogen peroxide.

13. The method of manufacturing a semiconductor device according to claim 10, wherein said alkaline liquid is a mixed solution containing choline and aqueous hydrogen peroxide.

14. The method of manufacturing a semiconductor device according to claim 10, wherein said first temperature is 250℃ or more.

15. The method of manufacturing a semiconductor

device according to claim 10, wherein said second temperature is 550℃ or less.

16. The method of manufacturing a semiconductor device according to claim 10, wherein heat-treating at said first temperature is performed for a period of less than five minutes.

17. The method of manufacturing a semiconductor device according to claim 10, wherein heat-treating at said second temperature is performed for a period of less than five minutes.

18. The method of manufacturing a semiconductor device according to claim 10, wherein depositing said interlayer insulating film and forming said wiring layer are performed at a temperature lower than said second temperature.

19. The method of manufacturing a semiconductor device according to claim 10, wherein depositing said interlayer insulating film and forming said wiring layer are performed at a temperature of 500℃ or less.